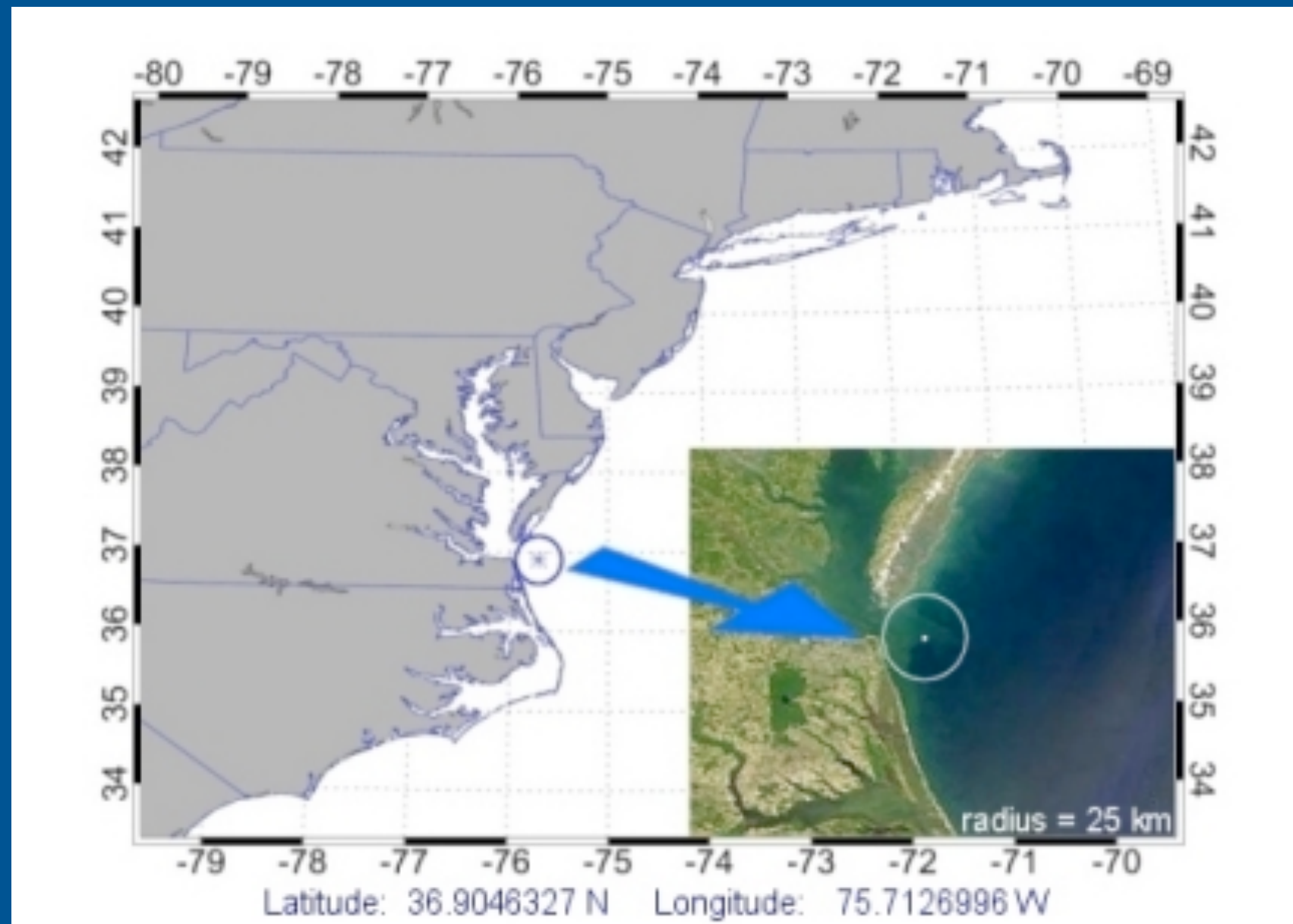


The Future of COVE: Operations and Instrumentation After DOE Renovations of the Chesapeake Lighthouse

Greg Schuster
Bryan Fabbri
Fred Denn
Bob Arduini

Acknowledgements

- Jim Green (NREL)
- Will Shaw (PNNL)



History of Chesapeake Lighthouse



1930

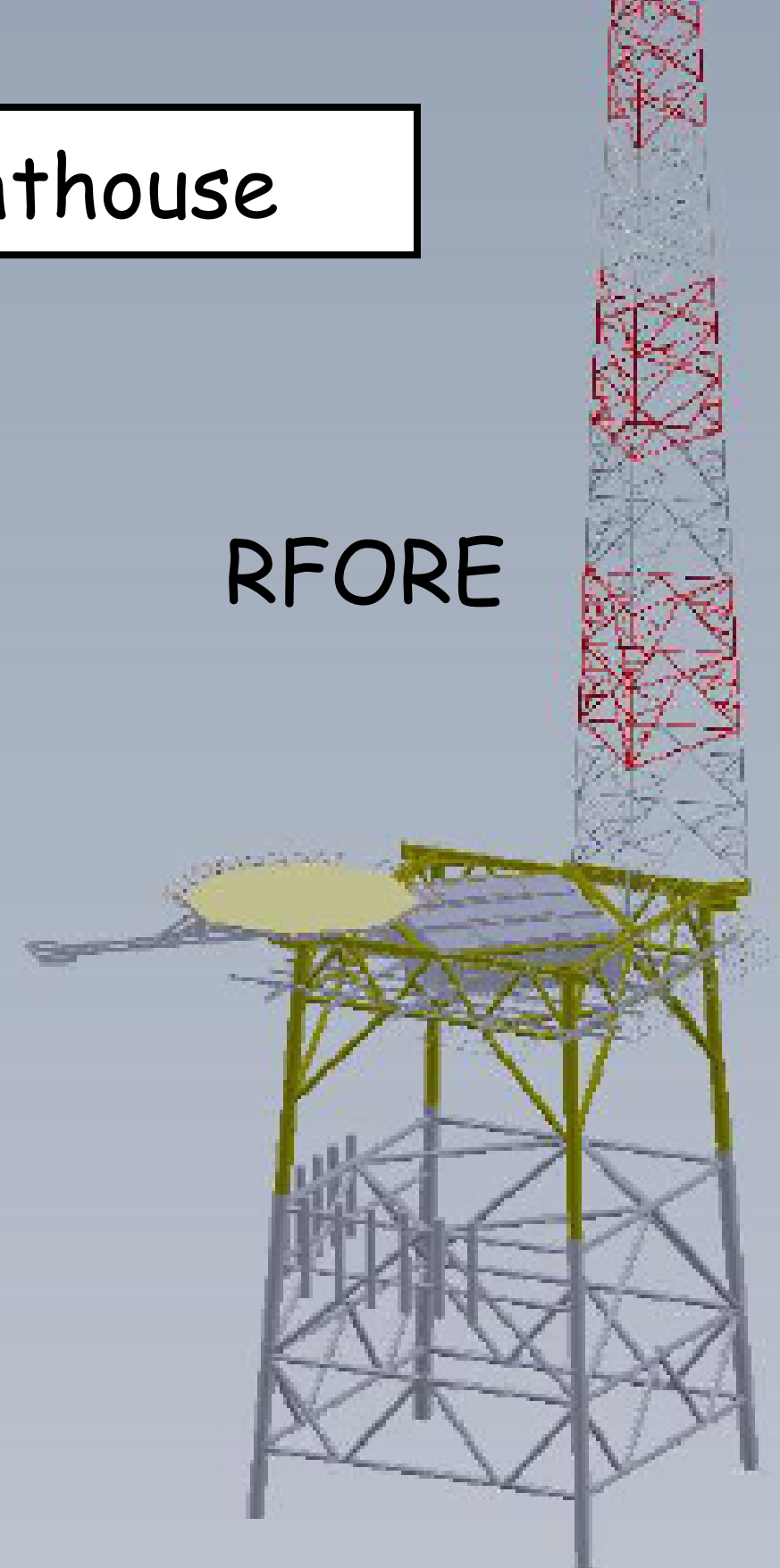
1965

History of Chesapeake Lighthouse



1930

1965



RFORE

2016?

DOE Rationale for Offshore Wind Program

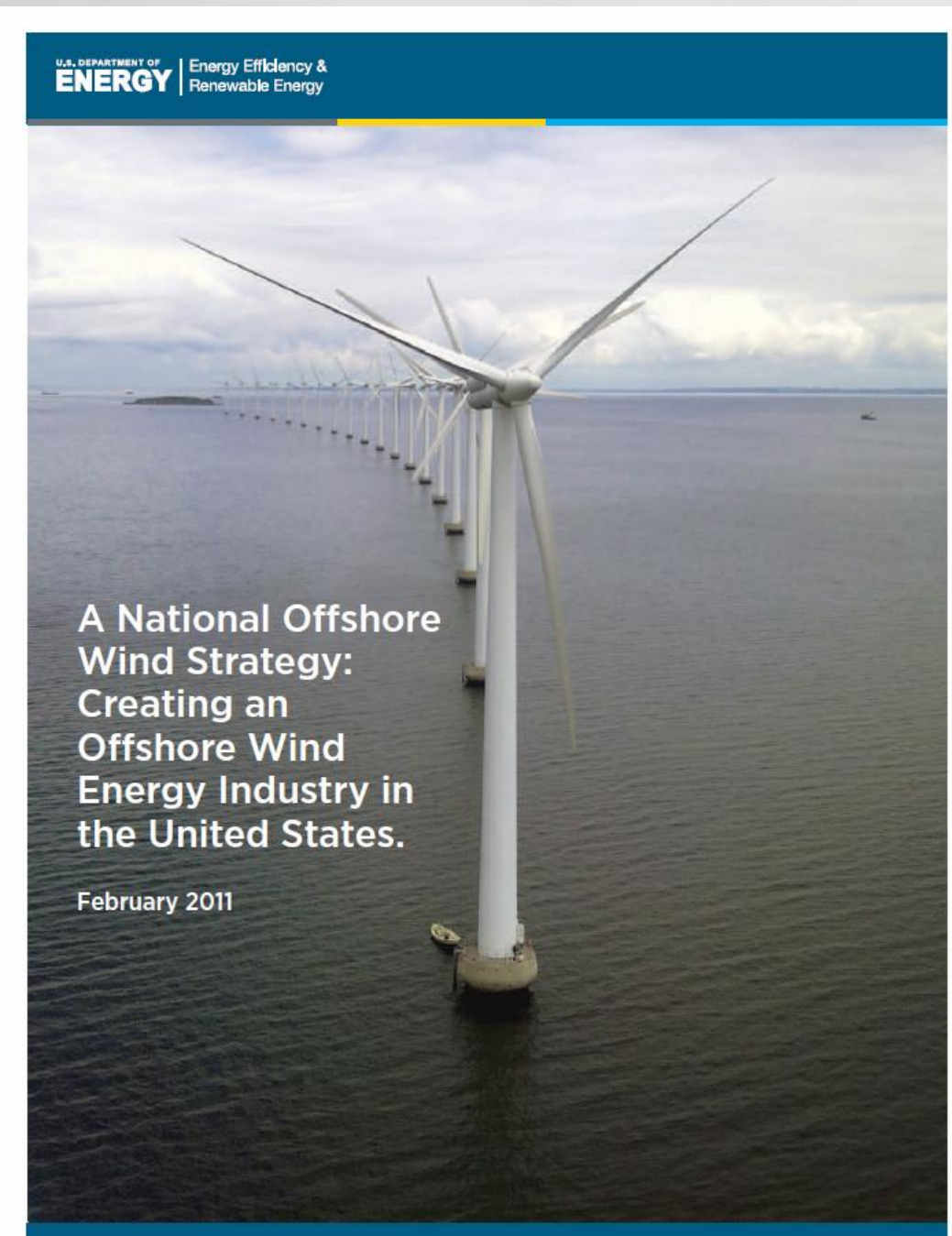
- President Barack Obama called for 80% of the nation's electricity to be generated from clean energy sources in his 2011 State of the Union Address.
- United States could generate 20% of its electricity from wind energy by 2030.
- Offshore winds blow stronger and more uniformly than on land, resulting in greater potential generation.

► *A National Offshore Wind Strategy: Creating an Offshore Wind Energy Industry in the United States*, DOE report, Feb 2011.

Barriers to Offshore Wind Energy Access

Barriers to Offshore Wind

- ▶ Siting and Permitting
- ▶ Complementary Infrastructure
- ▶ Energy Resource Planning
 - Currently, no continuing wind data at hub height in U.S. coastal waters
 - No current validation for cost-effective alternatives to costly offshore assessment towers
 - Lack of suitable data for evaluation of offshore wind and turbulence models
 - Lack of environmental data to facilitate permitting



RFORE Project Roles

DOE/EERE Wind and Water Power Technologies Office

- ▶ Programmatic priorities
- ▶ Project control

National Renewable Energy Laboratory

- ▶ Upgrade of Chesapeake Light Tower, including installation of 100-m meteorological tower
- ▶ Safety and maintenance

Pacific Northwest National Laboratory

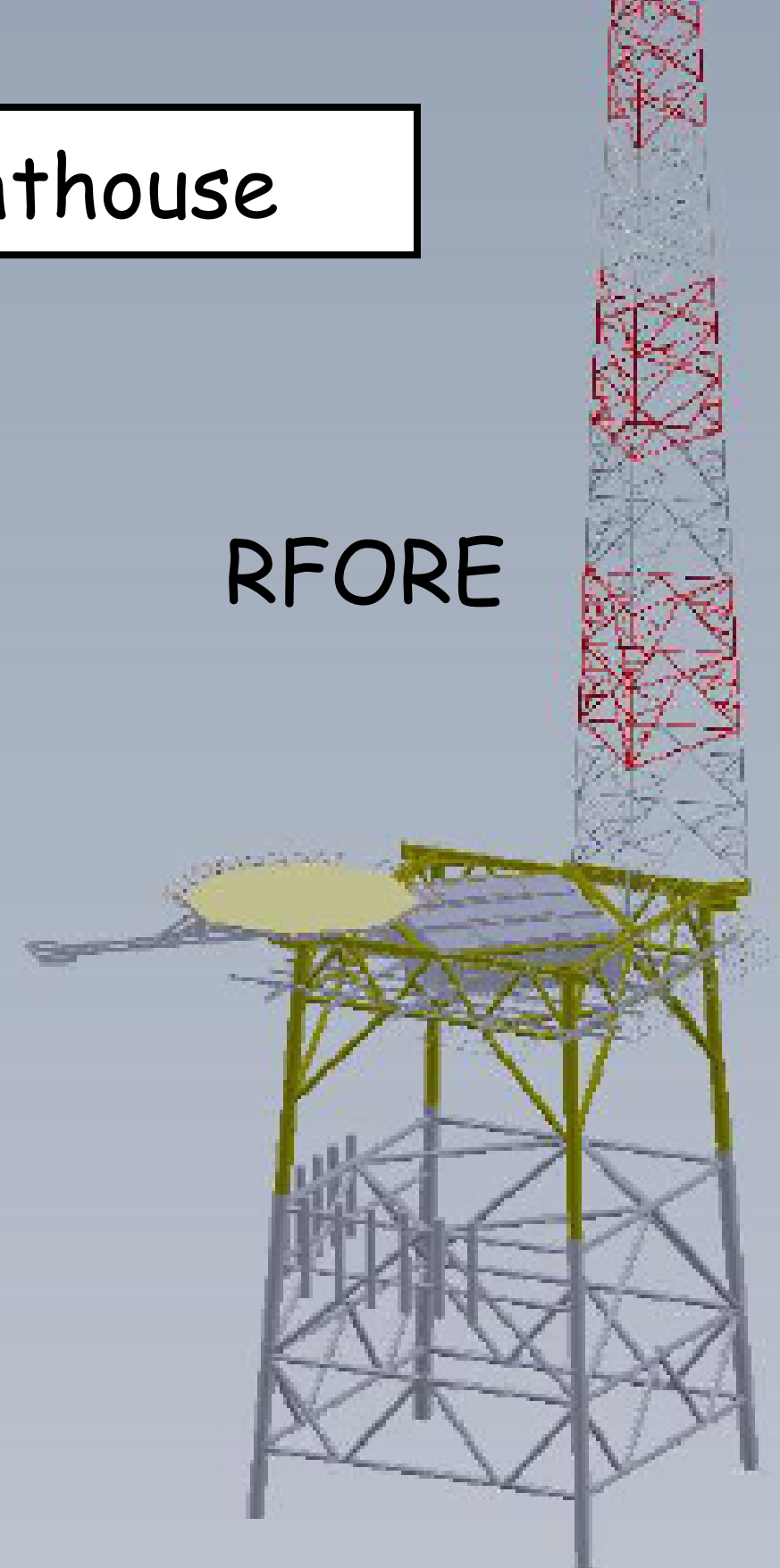
- ▶ Research agenda, including establishment of an interagency steering committee
- ▶ Data management facility

History of Chesapeake Lighthouse



1930

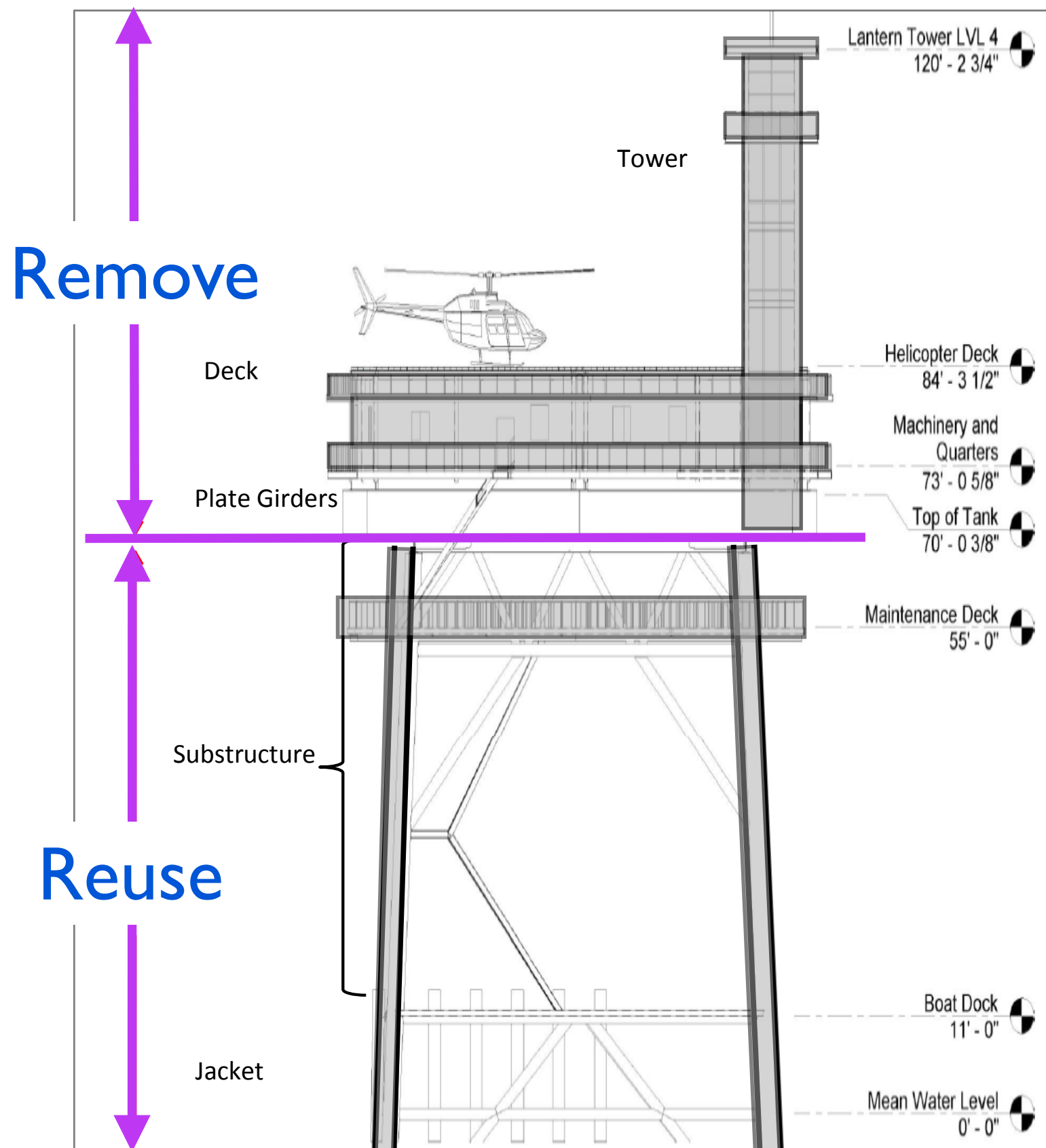
1965



RFORE

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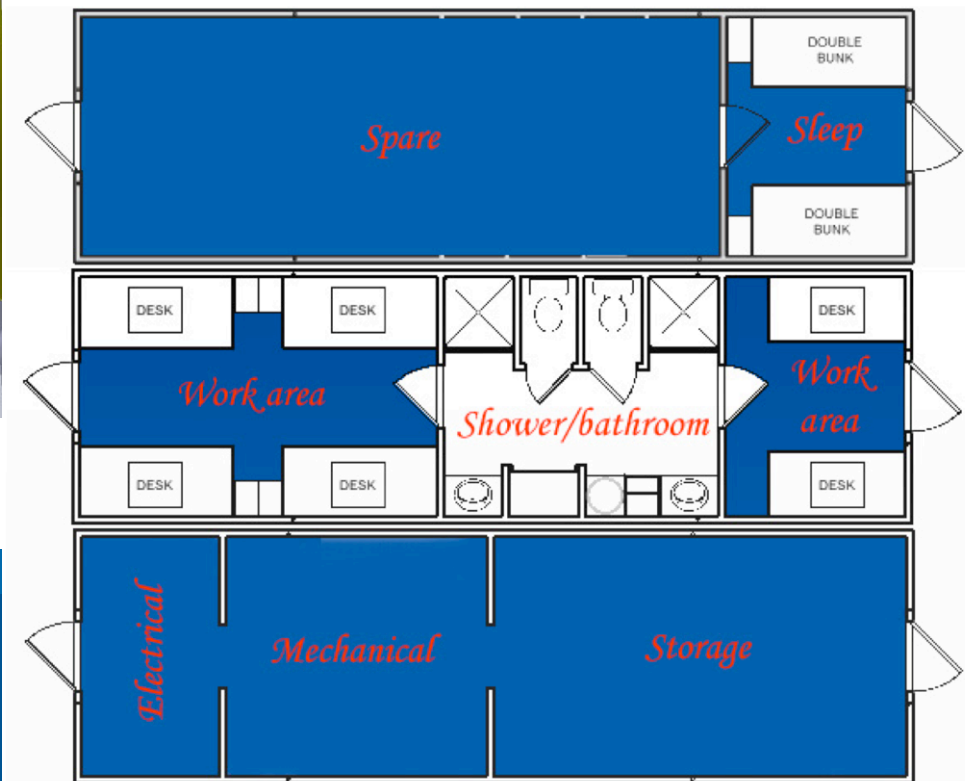
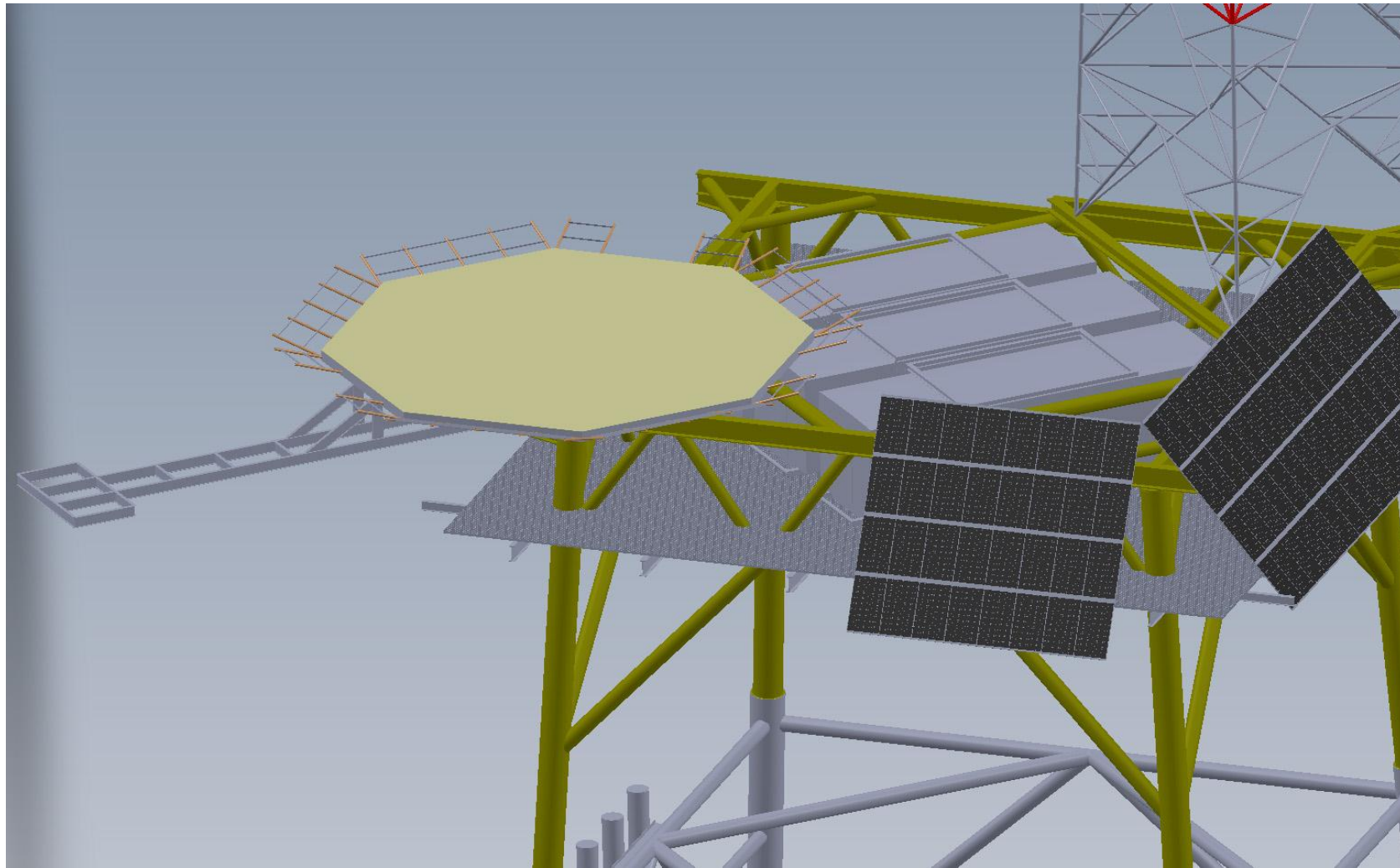
Demolition Plan



Ambrose Light Demolition, Sept 1999



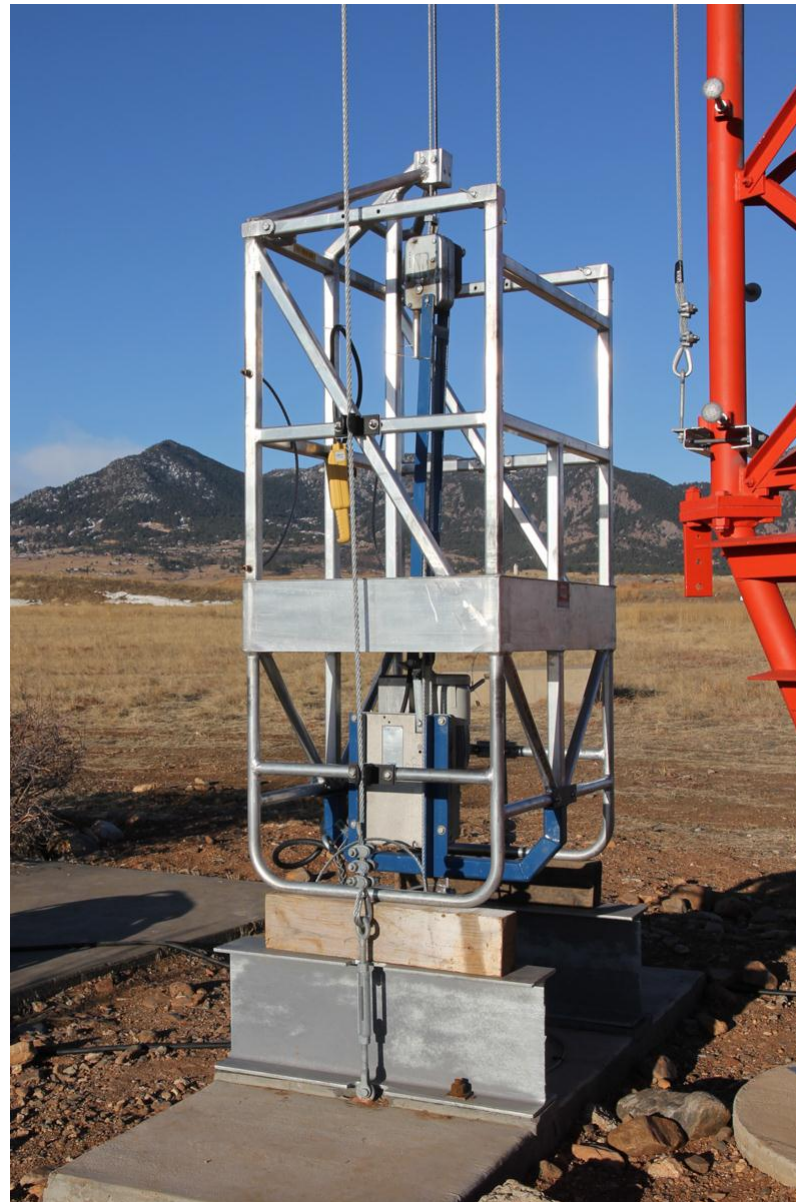
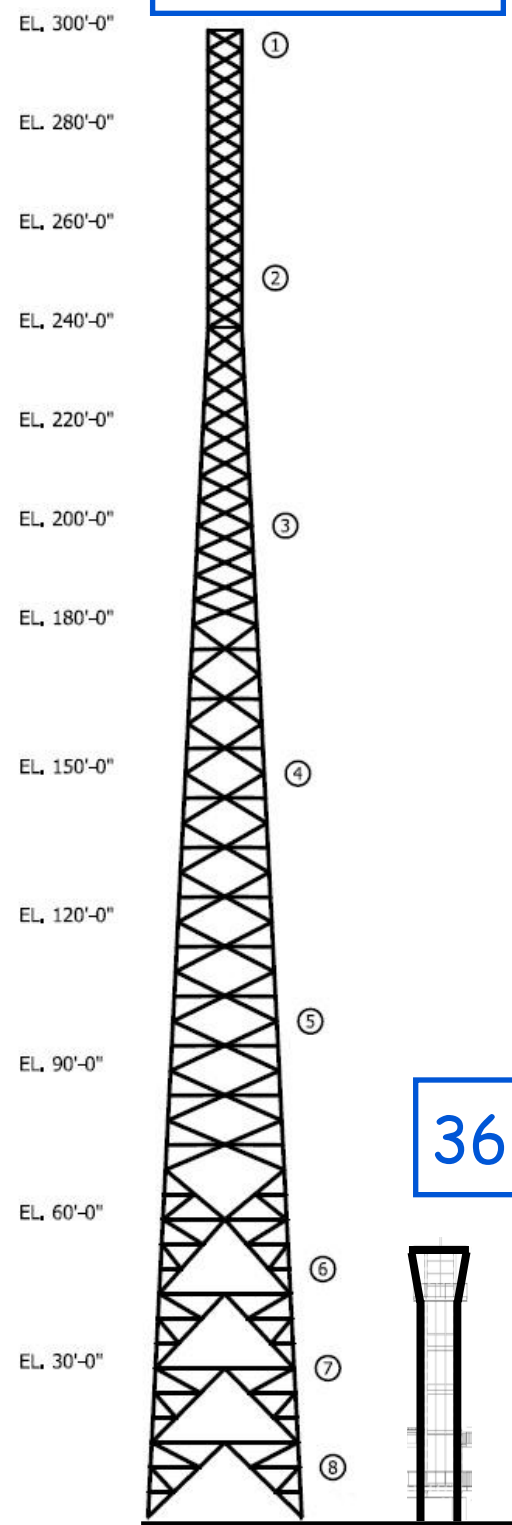
Deck Upgrade Concept



How Big is this Tower?

Service lift

120 m ASL



NATIONAL RENEWABLE ENERGY LABORATORY

12

- speed limit is 35ft/min
- a full ride to the top would be about 10 minutes



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Core Instruments—Mast-Mounted

- ▶ Industry-standard cup anemometers and vanes 8 levels from 40 m to mast top (≥ 100 m MSL); sampling interval of 1 s (3 booms at each level)
- ▶ Sonic anemometers sampling u , v , w , T_v at 20 s^{-1} at 3 levels; possibly fast-response q as well
- ▶ Mean T , q at 1 s^{-1} at three levels to mast top
- ▶ Barometric pressure, sampled 1 s^{-1}
- ▶ Bolometric SST measurement at 1 s^{-1}
- ▶ IR video camera for breaking waves, up to 30 s^{-1} frame rate



Core Instruments—Platform and Oceanographic

- ▶ Platform-mounted Atmospheric Measurements
 - Doppler lidar dedicated to vertical wind profiles averaged over ~15 min
 - Microwave radiometer profiler for T, RH profiles
 - Ceilometer for inversion height, cloud base height at intervals of ~2–120 s
 - Tipping bucket rain gauge for precipitation

- ▶ Oceanographic Measurements
 - “Sea snake” for reliable SST alternative
 - Acoustic Doppler profiler for 2-D wave spectrum and sub-surface currents

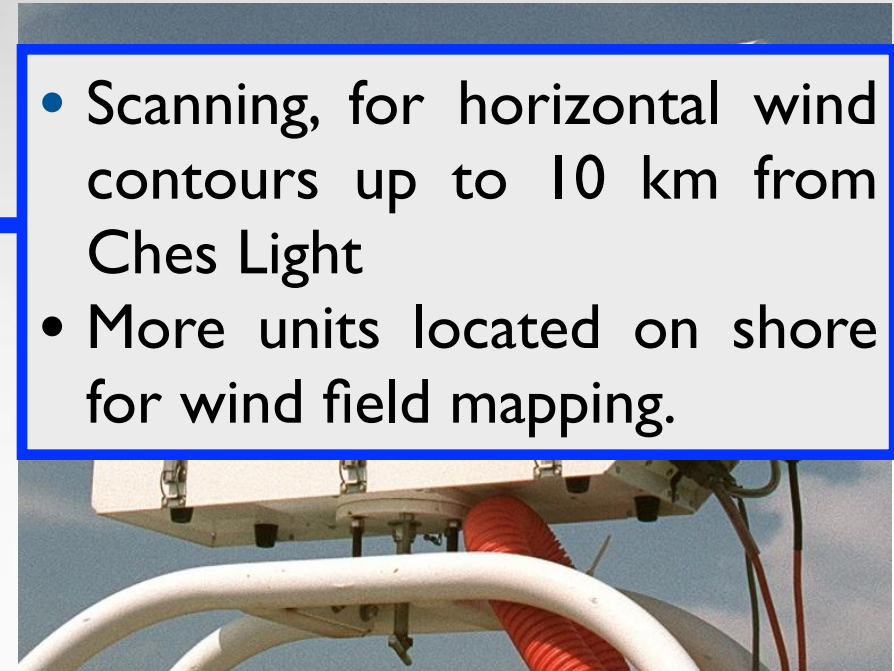


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- Scanning, for horizontal wind contours up to 10 km from Ches Light
- More units located on shore for wind field mapping.



▶ Oceanographic Measurements

- “Sea snake” for reliable SST alternative
- Acoustic Doppler profiler for 2-D wave spectrum and sub-surface currents



Additional Instruments



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- ▶ Atmospheric Measurements
 - Wind profiling radar
 - Sodar
- ▶ Oceanographic Measurements
 - CT probes for temperature and salinity profiles
- ▶ Environmental Measurements—Atmospheric
 - X-band radar for bird and bat detection
 - Passive acoustic bat detectors, at least two levels on mast
 - IR camera for bird, bat detection
 - Video camera for bird identification
- ▶ Environmental Measurements—Subsurface
 - Echolocation system (clicks)
 - Hydrophones for whale detection
 - 3-D acoustic camera
 - Subsurface video
 - Magnetometer



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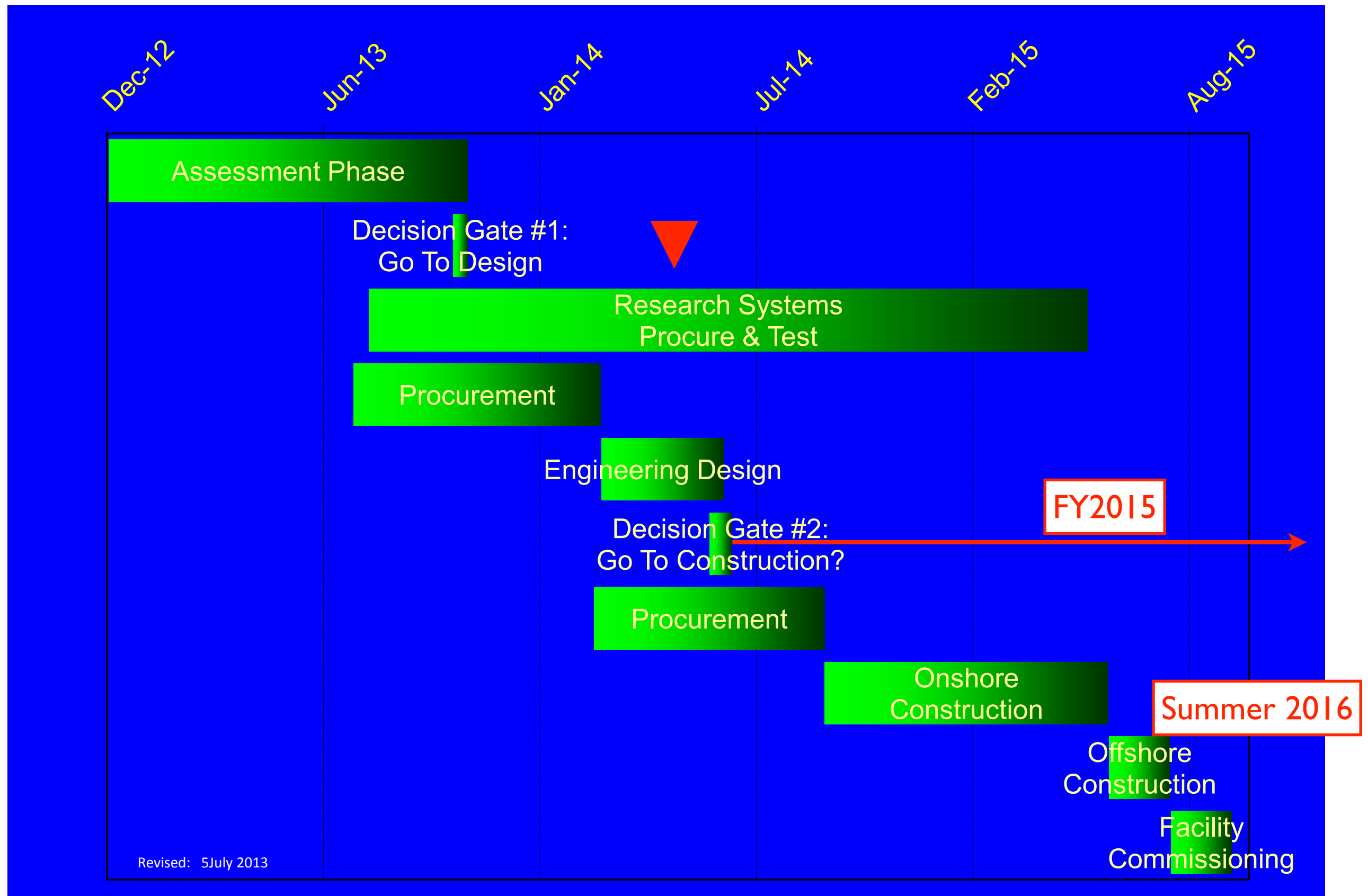


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RFORE Project Schedule as of July 17, 2013



Conclusions

- DOE/NREL/PNNL plan to make the Reference Facility for Offshore Renewable Energy (RFORE) a world-class research platform.
- RFORE will have a tall met tower, state of the art wind mapping, and other instrumentation that would benefit transport modeling at the COVE site.
- COVE instrumentation to remain intact at Ches Light until DOE “remodels” the site into RFORE, which is now expected in Summer 2016. (However, a negative decision from DOE for proceeding could change everything.)
- DOE is happily accomodating COVE instrumentation, and including us in the re-design process.